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ABSTRACT

A short history of the use of the metric system is given. The role of education in metrication is discussed. The metric activities of three groups of metrics advocates, the business community, private groups, and government agencies, are described. Arguments advanced by metric opponents are also included. The author compares the metric debate with the "new math" and textbook controversies, and indicates that educators will have to deal with the metric issue in the coming decade. (MK)

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METRIC EDUCATION AND THE METRICS DEBATE: A PERSPECTIVE

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Americans, the inventors and missionaries of a society that knows few peers in standardization, do indeed fail to agree with the rest of the world on a basic standard of measurement, the metric system.

This situation does not stem from an historical haphazard. In fact, the United States was the first country to consider the adoption of the metric system after it was created and began to be implemented in France around 1791. Revolutionary figures, such as Thomas Jefferson and John Quincy Adams, gave a lot of consideration to the question. The Constitution plainly gives to Congress the power to "fix the standard of weights and measures." But, as decimal currency was adopted, the metric system was rejected. Despite an intermittent debate which ensued for the next two hundred years about the possibility of a changeover, all successive attempts to make the United States a metric nation failed for the simple reason that most of the U.S. foreign trade was with the non-metric Commonwealth.

In 1965 the British government announced that it would abandon the imperial system in favor of the metric system. South Africa, Australia, New Zealand, and Canada quickly followed, leaving the United States as the only major nation not committed to "metrication," a word coined for the occasion by the British.

Consequently in 1968 Congress ordered a Metric Study to assess the impact of conversion. In 1975, after much discussion, Congress passed the ambiguous Metric Conversion Act. From this

period emerged a rejuvenated controversy which I will refer to as the Metrics Debate.

If asked to name some contemporary "politico-scientific" controversies, Americans would probably mention the nuclear debate first. The Metrics Debate is not one of these high profile debates, nor has it yet received much attention from social watchers. It is, however, rampant. A great number of articles about metrication have been published by newspapers and magazines. It is a fact that these articles incite many responses from the readers who take strong positions either for or against metrics.

In 1976 the Federal Highway Administration started a nation-wide plan to convert all road signs to metric measurements. The reaction was immediate; the agency was flooded with five thousand letters, most of them vehemently opposing the change. The agency dropped its national plan. Metrication had touched a highly sensitive issue.

Now metrication is reaching the school system, one of the last grass-roots institutions of this country. This is, as we see now, a decisive step. For reasons that must be studied, the educational community is now the most active supporter of metric conversion.

Education takes the lead

Education, like metrication, is a process of change. And in the last three decades education has been the standard way of iniating social reform; desegregation is one example. The chore of metric education, however, is huge. With the advancement of metrication, the United States will become a large classroom and every American a student for whom metric programs and curricula will have to be designed, published, and taught. This formidable educational task -- the largest ever -- follows the fading of the multimillion-dollar federal curriculum effort spurred by Sputnik, and comes during a period in which the role of science education in the schools is decreasing. Indeed, it is impossible not to notice the historical setting in which the idea of metrication reached the educational community. In 1971, while the Science Curriculum Reform Movement of the 1960's was losing momentum, the results of the Congress mandated Metric Study were published in thirteen volumes. The authors of the sixth report, entitled "Education," found that "the advantages of going metric in education are significant but not overwhelming."(1) But, in the absence of a national commitment to metrication, they warned educators not to take the lead in promoting the metric system as the only or primary system of

measurement, for they thought that its exclusive use, especially in science education, could lead to "a cultural isolation of science reminiscent of C.P. Snow's Two Cultures." Nevertheless, they did list the educational disadvantages of not going metric.

Without guidelines other than this study, the U.S. Office of Education funded five major metric education projects. This took place before Congress passed in 1974 an amendment to the Education Act of 1965, creating a Metric Education Program within the Office of Education. Again, this amendment -- the first to authorize funds specifically for metric education -- was passed before a decision had been reached on a national policy regarding conversion itself.

A 1978 General Accounting Office report states that the 1974 amendment contained "assertions about the metric system dominance and inevitability... directed to the educational community to get the schools going in teaching metric."(2) In any case, the educational community jumped at the new financial opportunity. In two years, the Metric Education Program received 585 applications requesting funds for metric projects, and selected 72 of them worth two million dollars.(3)

Since then, about ten million dollars have come from the federal budget to support metric education. Funding of this magnitude can only be compared to the sums received in the 1960's by what is now known as the Science Curriculum Reform Movement. Seen as a curriculum change affecting every American, metric education is the continuation of that reform movement.

Consequently in the mid-seventies, the "education market" was flooded in record time with literally thousands of metric texts and educational aids. From McGraw-Hill to Walt Disney, many corporations formed special metric divisions. Much of what was proposed was inadequate, misdirected, or sometimes plainly wrong. It became so confusing that the American National Metric Council (ANMC) felt it necessary to publish a Metric Guide for Educational Materials to help educators select correct material.

The mid-seventies also marks the broadening of the educational community commitment to metrication. While math and science teachers had been metric advocates for many years (since 1948 for the National Council of Teachers of Mathematics) teaching metric in the classroom was difficult without state and/or local recommendations. From 1975 to 1979 all state boards or departments of education started to officially support metrication, and half fixed target dates for the teaching of

metrics as the primary system of measurement. It is difficult to understand the reasons of such unanimity and haste, but certainly the so-called "inevitability syndrome" and the subtle pressure from the U.S. Office of Education played a role.(4) Moreover, the state and local decisions to go metric in the schools were often made by non-elected officials. Only the Minnesota Legislature passed a metric statute on which the State Commissioner of Education could base his decision to go metric. The Florida Legislature revoked its 1980 deadline to make the state schools metric; now the metric system is only optional in Florida schools.(5) It must be noticed here that the target dates for predominently metric instruction are by and large symbolical. Nevertheless, despite the decentralization of the American school system and the legal difficulty of imposing state curricula at the local level, the states can impose their curriculum choices through the funding of approved textbooks.

The two obstacles remaining in the way of the educational community metric leadership are 1) that the majority of teachers still lacks the knowledge and skills to teach metrics, though most of metric education efforts have been for teacher training; and 2) the fact that the role of schools has not been expanded to meet the metric needs of adults.

In 1980, although no national statistics are available, we may assume that the metric system is taught in the great majority of this country's schools. Young Americans are becoming the disciples of the metric system. The educational community, working to prepare students for a metric society, may create the future it anticipates. But for now, the United States is far from being a metric society. Faced with this discrepancy, educators must pay attention to the revived Metrics Debate. This is why I am now reviewing its actors, their arguments, and their views on metric education.

Metrics advocates and metric education

Aside from the educational community, I distinguish three categories of metric advocates.

First the business community, with maybe the exception of the small businesses, is in principle very favorable to metrication. Yet it is concerned with how conversion will proceed. Meetings such as the ANMC annual conferences are evidence of this concern. Consequently, the business community has taken, by and large, a wait-and-see attitude. Only when conversion is industry wide, as it has been for the wine industry, can we be assured that metrication is moving ahead fast. On the metric education front, business is essentially preoccupied with employee training. Few corporations have planned substantial

educational programs, integrating the metric system into their employees' lives. The existing programs are mostly conversion and job oriented.

A second category of advocates of metrication is constituted by private groups, mainly the ANMC and the U.S. Metric Association. The ANMC was created in 1973 by American corporations to plan and coordinate metrication in the private sector. It is located in Washington, D.C., and supported mainly by membership dues. It has produced seventeen draft conversion plans on an industry-by-industry basis. Strangely, the ANMC has long claimed not to be an advocacy organization. This position is now changed. Much older, the non-profit U.S. Metric Association was founded in 1916, and has since been a place for citizens to militate in favor of conversion. Its membership, which consists mainly of educators, scientists, and engineers, has been closely associated with every attempt made to adopt the metric system in the 20th century. The association is located in Boulder, Colorado, and has counterparts in Canada and in France.

The educational preoccupations of these two associations have been broader than those of individual businesses. They have tried to present as many facets of the metric system as possible. This has been carried out primarily by means of publications and meetings. The ANMC and the U.S. Metric Association have developed or helped develop metric guidelines for employee training, vocational and engineer education, consumer education, editorial content, and educational material. The annual conference is a cornerstone of ANMC's educational program. Moreover, the U.S. Metric Association recently started to organize a Certified Metrication Specialist Program to provide much needed metric experts.

Finally, and despite past hesitations, government agencies constitute the third category of advocates of metrication. A precursor in this category was the National Bureau of Standards (NBS). From its foundation in 1901, it has relayed the National Academy of Science in its long time efforts to obtain the adoption of the metric system.(6) From 1968 to 1971, the NBS prepared the thirteen-volume Metric Study. At the time of the "Silent Majority," Daniel DeSimone, the Study director, saw an alternative: either the Government would do nothing to impede or foster gradual metric conversion, or it would set up a plan for coordinated conversion. The second possibility was proposed by the Government to Congress which finally passed the 1975 Metric Conversion Act without retaining any deadline. The Act created, however, the U.S. Metric Board,

a new federal agency whose responsibility is "to coordinate the voluntary conversion to the metric system." At the outset there was a controversy about the exact role of the Board, whether it was that of an advocate of conversion or that of a neutral overseer. The dust has now settled, and the Board has been working since 1978 with an Interagency Committee on Metric Policy, regrouping 37 federal agencies. To date twelve or so agencies have developed a formal agency policy on metric use, and have, therefore, joined the ranks of the proponents of metrication.

To fulfill its self-imposed metric educational role, the National Bureau of Standards established the National Metric Speakers Bureau in 1976. Persons knowledgeable about the metric system, mostly educators, were invited to become speakers. Their number was 273 at the end of 1976, with at least one speaker in each state. Each speaker was supplied with a basic set of talks and asked that no conflicting viewpoints be presented.(7) The Speaker Bureau has now been discontinued; its function, if not its philosophy, has been taken over by the U.S. Metric Board. Indeed, the public information share of the Board's budget has been by far the largest. In its February 1980 hearings, however, most participants expressed the view that the Board should intensify its public awareness and education programs. The same criticism could be addressed to other federal agencies, with the exception of the U.S. Office of Education.

Metric challengers' arguments

The most numerous category of metric opponents, although the least vocal, is composed of the 45% of Americans who in the polls refuse metrication. Since 1973, their opposition has been growing steadily with their awareness of the issue. In 1978, only 25% of those polled wanted the United States to adopt the metric system. Clearly there is no national consensus for conversion. Many of those who say "no" are parents who may resent being unable to understand or keep up with the metric education of their children. This situation recalls other curriculum changes which left many parents puzzled and angry. We shall return to this remark later.

In addition to this diffuse opposition, there are some anti-metric citizen action groups which can be seen as counterparts to the pro-metric groups. Their impact on the metrication process is still hard to assess, but their positions have been well-publicized. In the Western United States, the Do Not Think Metric Association is headed by Mr. Dean Krakel, director of the National Cowboy Hall of Fame. Members of this organization have filed suit against the Government for its efforts at conversion. They especially object to teaching metrics in the schools because

they claim it will destroy tradition, heritage and local pride, and will be confusing. For them metrication is part of "all this experimentation and change that educators keep shoving down our throats."(8) Much of their opposition appears to be based on their being Westerners. Challengers of metrication, however, have also regrouped in other parts of the country. In the South is based the American Measures and Standards Association whose president testified in the Phoenix hearings of the U.S. Metric Board. In the East, Mr. Seaver Leslie, an artist, heads the Americans for Customary Measures. In May 1979 this group organized a well-publicized Customary Weight and Measure Festival in Central Park. They claim it would be impractical to be limited to a base ten system, or to adopt units that do not correspond to the dimensions of the human body. They add that "abandoning our system of weights and measures would be a grave psychological blow to the elderly, emotionally handicaped, and any person outside the scholastic process... The people of this country should not be coerced to convert... to a language of technocracy and multinational trade."(9) Following the same arguments thousand of Canadians have joined anti-metric clubs, especially in Ontario.

Finally, and surprisingly, a certain number of scientists is opposed to metrication. This opposition gathered enough momentum within the scientific community at large for the American Association for the Advancement of Science to organize a special panel "to air these concerns" at its 1979 Annual Conference. Already in 1971, John Bellamy of Wyoming University had proposed an ingenious "geo-system" of measurement based on natural constants. But the movement really started in 1975 when a group of physicists of the University of Colorado, lead by Dr. Barlett, petitioned the Government to reconsider the adoption of the metric system which, "as a crystallization of basically 19th century technology..., is poorly suited to 20th century developments."(10) A "better" system would be based on some physical constant of the universe, like the speed of light, and numbers more suitable to computers than decimals. This debate continued in the letters-to-the-editor columns of scientific magazines such as Physics Today. In one of these letters a scientist defended metrication by noticing that no system is perfect, and therefore, the only requirement for a system of measurement is its universality. But beyond the argument of a better system, it appears that scientists are wary to take the eventual blame of being an elitist group which legitimates the adoption of the metric system.

The challengers of metric adoption have interesting ideas and should be taken seriously. It is too easy to accuse them

of irrationality or backwardness, or merely lack of metric knowledge. In fact, as we have seen, some scientists oppose metrication, and, for different reasons, public resistance to conversion has grown as familiarity with metrics has increased. The Metrics Debate should not be regarded primarily as a battle between enlightenment and obscurantism, or between progressives and reactionaries. As strongly as metric advocates want to change their future, metric challengers want to preserve and control their present. When they argue, for example, that they never voted on metrication, they refer to the American democratic ideal. From this point of view, the efforts of educators to impose metric curricula in the schools with the aid of federal and state funds can be regarded as an attempt by a distant and elitist authority to uproot traditions and values.

Here is the ringing bell: values. Economics is the least of challengers' objections to metrication. Some have classified the Metrics Debate as political/emotional. I think it is fairer to say that the arguments used by opponents, as well as by some proponents of metrication, are often normative, that is, subject to personal value judgments. Who can decide, for example, which system is the most practical ? When the individual is affected, scientific and economic merit does not resolve value differences.

Indeed, in this country where ideologies are suspect, the Metrics Debate is, in essence, ideological, and expresses wide concerns with the role of education and science in our society. In that perspective, the Metrics Debate can be compared to other recent debates concerning science education.

Two comparisons

At least two contemporary educational issues share many characteristics with the Metrics Debate and have direct relevance for metrication in America.

The first of these controversies is the popularly called "New Math" dispute. During the 1960's, the National Science Foundation joined state and local educational institutions in a massive effort to up-date mathematics teaching at the primary and secondary levels. The goal was a major reconstruction of the scope, sequence, and pedagogy of school mathematics. At the end of the 1960's, though, strident criticism from teachers, parents, and the popular press forced a re-examination of the various changes. In 1973 a mathematician, Morris Kline, published the best-seller Why Johnny Can't Add, or the Failure of the New Math. Today, although the legacy of the changes is important, few if any of the goals of the reform have been realized.

The similarities of the New-Math reform with the Metrics Debate are many. At the outset, there was confusion over the proper goals of the reform. Like in the case of metrication, many resented the bureaucratic imposition of a new curriculum. Often the dispute resulted in a battle between the practical against the theoretical, with the New-Math proponents claiming that, for example, set theory was "easier" than previously taught topics. The then unrecognized "math anxiety" was overlooked. But today "metric anxiety" might explain why women, who suffer from math anxiety more than men, oppose metrication significantly more than men do. Moreover, the comparison can be carried outside the United States, in countries such as Canada and Great Britain where the New-Math curricula, imposed by central ministries of education, have been subject to criticism, like metrication, although to a lesser degree than in the United States.

More recent and still active are the specifically American textbook controversies. After having accomodated minorities and women, publishers and educators in the 1970's have faced rising pressure from citizens who think elementary and high-school texts have strayed too far from traditional values. These citizens have criticized, in particular, the content of the teaching of biology and the social sciences, and have contended that their evidence for Biblical creation deserves "equal time" with Darwinian evolution. In 1975 the controversy reached a national level over the National Science Foundation funding of a social science text, Man:A Course Of Study, based on evolutionary assumptions. This caused a decrease in federally supported curriculum changes. Today, despite the solid backing of the theory of evolution by most biology teachers, many school districts, following state guidelines, have to present alternatives to the theory of evolution.

Again there are several parallel traits between the textbook controversies and the Metrics Debate. A common superficial trait is the coexistence in the classroom of two teachings, with one of them being favored by the educators. In both cases, a seemingly unquestionable curriculum was invested with moral and social persuasions. The textbook watchers, like the metric challengers, claim that education, as a means of change, must reflect community values and, thus, be locally controlled. Neither Creationists nor anti-metric groups dissociate scientific arguments from value questions. Furthermore, "creationist scientists" have sided with the opponents of evolution, thereby legitimizing them, as have some scientists with the adversaries of metrication.

Of course the Metrics Debate, like the two preceding controversies, is not taking place in a social vacuum. American society is experiencing a period of disillusionment. Americans are becoming increasingly more cautious about technology and its expertise. The times favor serious assessments of impact of all kind of projects. There is a new respect for tradition and values, and a tendency toward the preservation of the past. Extravaganza and expensive programs are severely cut. More and more people would like to control the engine of change which is embodied in science. And likewise, many parents would like to be sure that curricula reflect their own ideologies and that schools teach "useful" skills (I am refering here to the Back-to-Basics movement.) The New-Math dispute, the textbook controversies, and the Metrics Debate are perceived as being somehow linked to broader concerns with the social, political, and cultural implications of education, science, and technology. And the core of the metric challengers' arguments is a reflection of these concerns.

Metric education is at the heart of a successful metric conversion. Both those who expect and those who reject metrication have come to realize it. Yet, if metric education is a lock what are its keys ?

For many metric education evokes a "think metric" public information campaign; for others it entails only the distribution of conversion tables; for most it signifies going back to school; for educators it means new responsibilities; for publishers it implies the design of new educational material; for advocates of metrication it is the means of a welcome social change; for their challengers it is the instrument of unwanted disruptions.

Indeed, metric education is many things at once. But for sure, it will be one of the frame-factors with which educators will have to deal during the 1980's. And if they want to avoid being caught in the middle of the Metrics Debate, educators have to watch closely the social barometer that the Metrics Debate, like other contemporary educational controversies, has become.

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Footnotes

(1) U.S. Metric Study, Education, NBS Special Publication 345-6 1971, p.4.

(2) U.S. General Accounting Office, Getting a Better Understanding of the Metric System Implications if Adopted by the United States, 1978, p.24-13.

(3) "Going Metric," American Education, December 1976, p.34.

(4) cf the excerpt of a letter by the U.S. Commissioner of Education, in U.S.GAO, op.cit, p24-15.

(5) "So you Think the Schools make the Curriculum", The New York Times, November 11, 1979, section 12.

(6) cf The National Academy of Science, edited by R. Cochrane, published by the Academy, 1978, p.171.

(7) John M. Tascher, A Survey of the National Metric Speakers Bureau, NBS Technical Note 960, 1977, p.1.

(8) Interview with Mr. Krakel, U.S. News & World Report, December 20, 1976, p.34.

(9) Letter to the editor by Mr. Leslie, The New York Times, January 10, 1979, p.C9.

(10) "Metrication and Motherhood," Physics Today, February 1976, p.15.